Hyperbaric Oxygen, Laser Photodynamic Therapies and Mitochondrial Support

Dr. Paul S. Anderson

HBOT 2018

Denver, Colorado

Abstract:

In the multiple therapies which may synergize HBOT the use of Laser (photodynamic) therapy is not well known in North America.

In this session Dr. Anderson will outline his use of HBOT-Laser and IV Therapies to enhance mitochondrial function and healing.

Mechanisms of action and common complementary modalities will be discussed.

Photodynamic Therapies
Laser

PDT - Laser

- Stem cell activation
- Immunologic stimulation
- Mitochondrial support
- Direct cancer therapy

- And: Synergy with HBOT

8.4 The role of Low- Level- Laser Therapy

- Proliferation: Stem cells need to be reproducible in adequate quantity.
- Differentiability: Stem cells need to have the potential to differentiate in the respectively required type of cell
- Purity: The differentiation process needs to be controllable: cells of one and the same kind have to be producible
- Pinpoint integrateability: The cell/ tissue replacements must be transplantable to the target part of the body
- Immunity of tumour development: It has to be assured that transplants don´t grow in an uncontrolled manner and thus induce tumour growth.
- Long term therapeutic effectiveness: The transplants need to prove their functionality and therapeutic effect in the long term.
- Immune compatibility: The transplants must be compatible to the immune system of the acceptor.

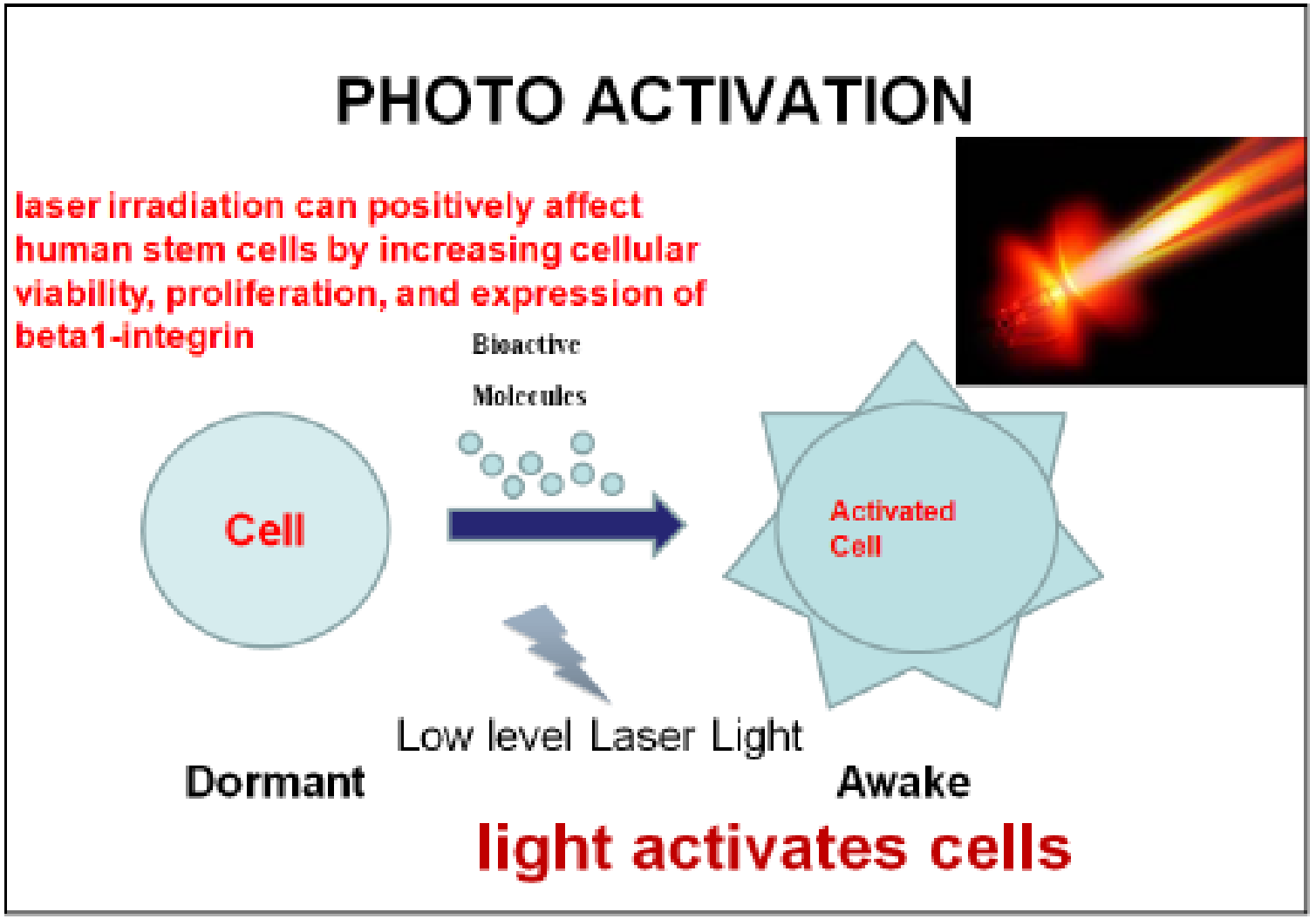


Fig.4: Effect on Low-Level-Laser Light on stem cells.

1) Lasers stimulate stem cells for heart repair. By: Prof. Uri Oron, Tel Aviv
(WALT-Laserconference, Washington DC, September 2014)
In a study conducted by Prof. Uri Oron, University of Tel Aviv, it was shown that a simple new process significantly reduces heart scarring after an ischemic event.

The method is called "shining" and consists of applying low-level laser energy to living bone marrow stem cells a few hours after a heart attack.
This procedure reduces scarring by up to 80 percent.

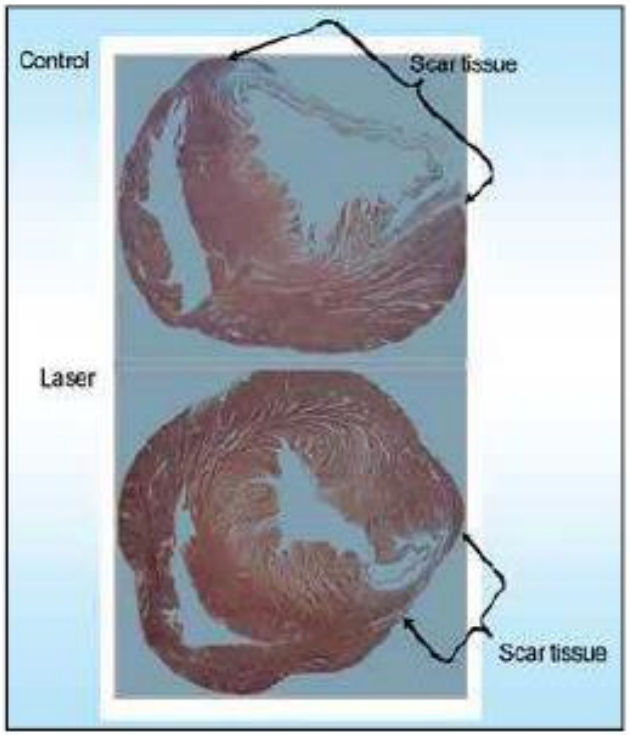
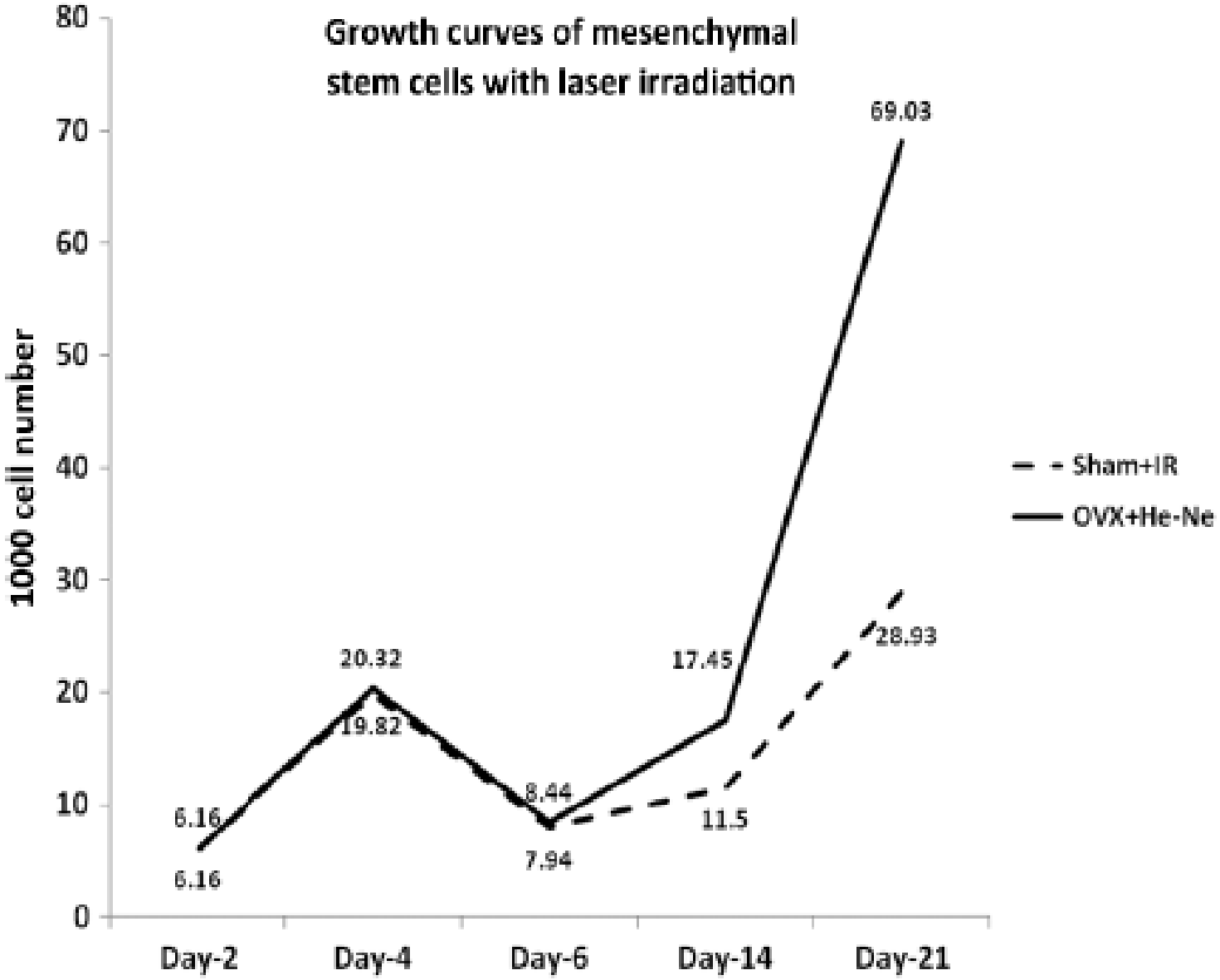


Fig.5: Reduction of scarring by up to 80 percent.


Growth curves of mesenchymal stem cells with laser irradiation
1000 cell number
80
70
60
50
40
30
20
10
0
Day-2
Day-4
Day-6
Day-14
Day-21
69.03
20.32
19.82
17.45
28.93
8.44
6.16
6.16
11.5
7.94
Sham+IR
OVX+He-Ne

FROM THE CLINIC

Autologous Stem Cell Therapy

A NATUROPATHIC APPROACH FOR THE TREATMENT OF CHRONIC MUSCULOSKELETAL PAIN CONDITIONS—Part I of II

HARRY A DELSON, ND, TYNA MOORE, ND, DC, AND PAUL ANDERSON, NMD

FROM THE CLINIC

Autologous Stem Cell Therapy

A NATUROPATHIC APPROACH FOR THE TREATMENT OF CHRONIC MUSCULOSKELETAL PAIN CONDITIONS—Part II of II

HARRY A DELSON, ND

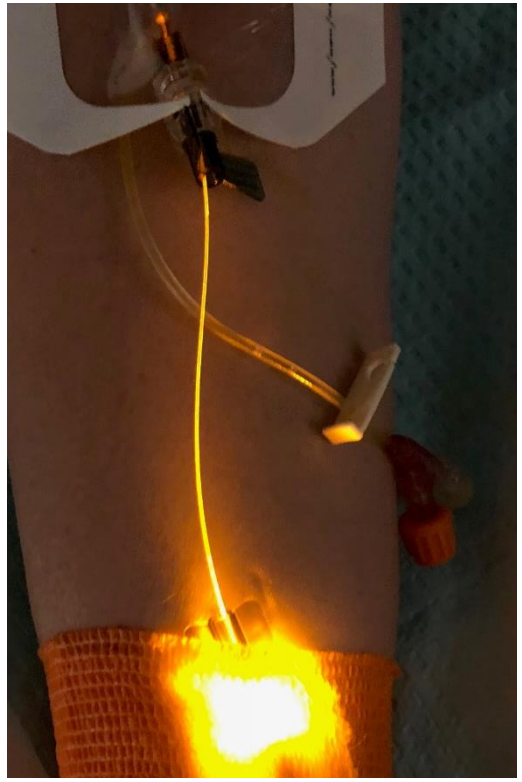
References / Links for those papers

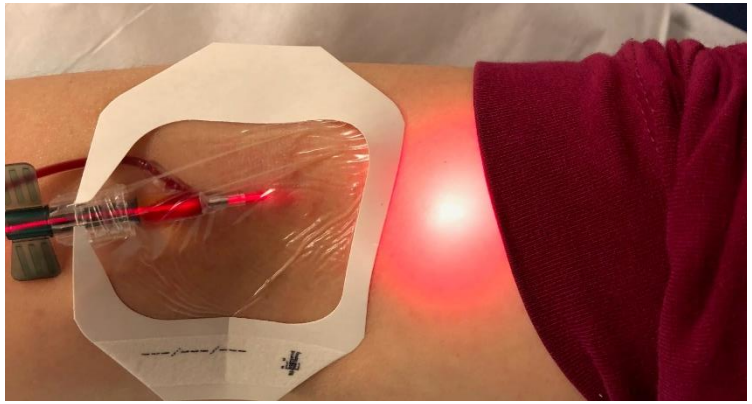
- **Stem Cell Support Part-1**

https://www.academia.edu/36317398/Stem_Cell_Support_Part-1_Integrative_Pain_Management

- **Stem Cell Support Part-2**

https://www.academia.edu/36317439/Stem_Cell_Support_Part-2_Integrative_Pain_Management





Given the MOA of PDT it appears that HBOT and PDT are synergistic:

Any Data?

PMID: 10691271 (2000) +

BACKGROUND AND STUDY AIMS: Experimental studies have shown that the cytotoxicity of porphyrins and related substances is mediated mainly by singlet oxygen and that hypoxic cells are less affected by porphyrins and light. In a clinical pilot study we assessed the use of photodynamic therapy (PDT) under hyperbaric oxygen (HBO), compared with PDT under normobaric conditions, in patients with advanced esophageal carcinoma.

PATIENTS AND METHODS: …Of the patients, **14 (12 with stage III cancers, and two with stage IV cancers) were treated by PDT alone**, and **17 patients (15 with stage III cancers, and two with stage IV cancers) received PDT under HBO at a level of 2 absolute atmospheric pressures (ATA).** Transcutaneous PO2 levels of 500-750 mm Hg under HBO, compared with transcutaneous PO2 levels of 60-75 mm Hg under normobaric conditions, were measured.

RESULTS: …The 12-month **survival rate was 28.6% for the PDT group and 41.2% for the PDT/HBO group.** Logrank test showed a difference in survival in favor of the PDT/HBO group (P = 0.059). No major treatment-related complication occurred, and the 30-day mortality rate was 0%.

CONCLUSIONS: **Combined PDT/HBO represents a new approach in the treatment of esophageal cancer which, in this pilot study, appears to have enhanced the efficiency of PDT.**

https://doi.org/10.1002/(SICI)1096-9101(2000)26:3<308::AID-LSM9>3.0.CO;2-B

(2000) +

Background and Objective: **The photochemical reaction of photodynamic therapy (PDT) depends on the presence of molecular oxygen. Because of anoxic regions in tumor tissue and vascular shutdown during PDT, the efficiency is limited. Therefore, the use of hyperbaric oxygen, which increases the oxygen in tumor tissue,** as well as the amount of singlet oxygen, may enhance the efficiency of PDT.

Study Design/Materials and Methods: **Twenty-three patients were treated by PDT alone** and **29 patients received PDT under hyperbaric oxygen** at a level of two absolute atmospheric pressures.

Results: …The mean overall survival was 11.3 months. The **mean survival time** for the **PDT group was 8.7 months and for the PDT/HBO group 13.8 months** (P = 0.021).

Conclusion: According to this pilot study, combined PDT/HBO represents a new approach in the treatment of esophageal and cardia cancer, which appears to have enhanced the efficiency of PDT.

https://doi.org/10.1002/lsm.1067 (2001) +

Background and Objective: Photodynamic tumor therapy (PDT) is based upon a photochemical reaction that is limited by the availability of molecular oxygen in the target tissue. The use of hyperbaric oxygenation (HBO) increases the amount of oxygen available for the process may thereby enhance the efficacy of PDT. We investigated the acute effects on tumor stenosis after combined PDT/HBO.

Patients and Methods: Thirty patients (22 males, 8 females, mean age: 68.8 years; range: 44–78 years) with **inoperable non-small cell bronchogenic carcinoma and endobronchial stenosis** were studied prospectively.

Results: …**A significant reduction of tumor stenosis ($P < 0.05$) and an improvement of the Karnofsky performance status ($P < 0.05$) were documented 1 and 4 weeks after PDT/HBO. No therapy related complications were observed.**

Conclusions: Although the small number of patients does not allow to draw definitive conclusions to be drawn, **the results suggests that combined PDT/HBO represents a new, safe, and technically feasible approach. It enables efficient and rapid reduction of the endoluminal tumor load and helps conditioning the patient for further treatment procedures.**

https://doi.org/10.1016/S1572-1000(04)00009-2

(2004) +

Introduction: … The aim of this study was to evaluate the additional effect of intraoperative photodynamic therapy (PDT) under hyperbaric oxygenation (HBO) if compared to decortication alone.

Patients and methods: From January 1993 to August 2003, decortication was done in 34 patients (28 males, 6 females; mean age: 65 years) suffering from advanced **malignant pleural mesothelioma.** Twenty-two patients received additional intraoperative PDT under HBO.

Results: At 6-month follow-up the Karnofsky performance status showed no significant difference (P≥0.05) between both groups. CT scans documented **focal regrowth of the tumour after 6 months in 10/12 cases of the non-PDT** group. **However, in the PDT group tumour regrowth was detected in only 9/22 cases at 6-month follow-up**.

Conclusion: Although the study includes only a small number of patients, it indicates that **additional PDT/HBO represents a safe and technically feasible approach in the palliative setting of advanced malignant mesothelioma of the pleura.**

DFP submitted to obtain the title of DEGREE in
BIOMEDICAL ENGINEERING
by **Olga Ciutad Castejón**

Barcelona, June 30th 2015

Director: Joan Francesc Alonso López
Escola Universitària d'Enginyeria Tècnica Industrial de Barcelona
Department (EUETIB)
Universitat Politècnica de Catalunya (UPC)

4.2.2 Cell cycle

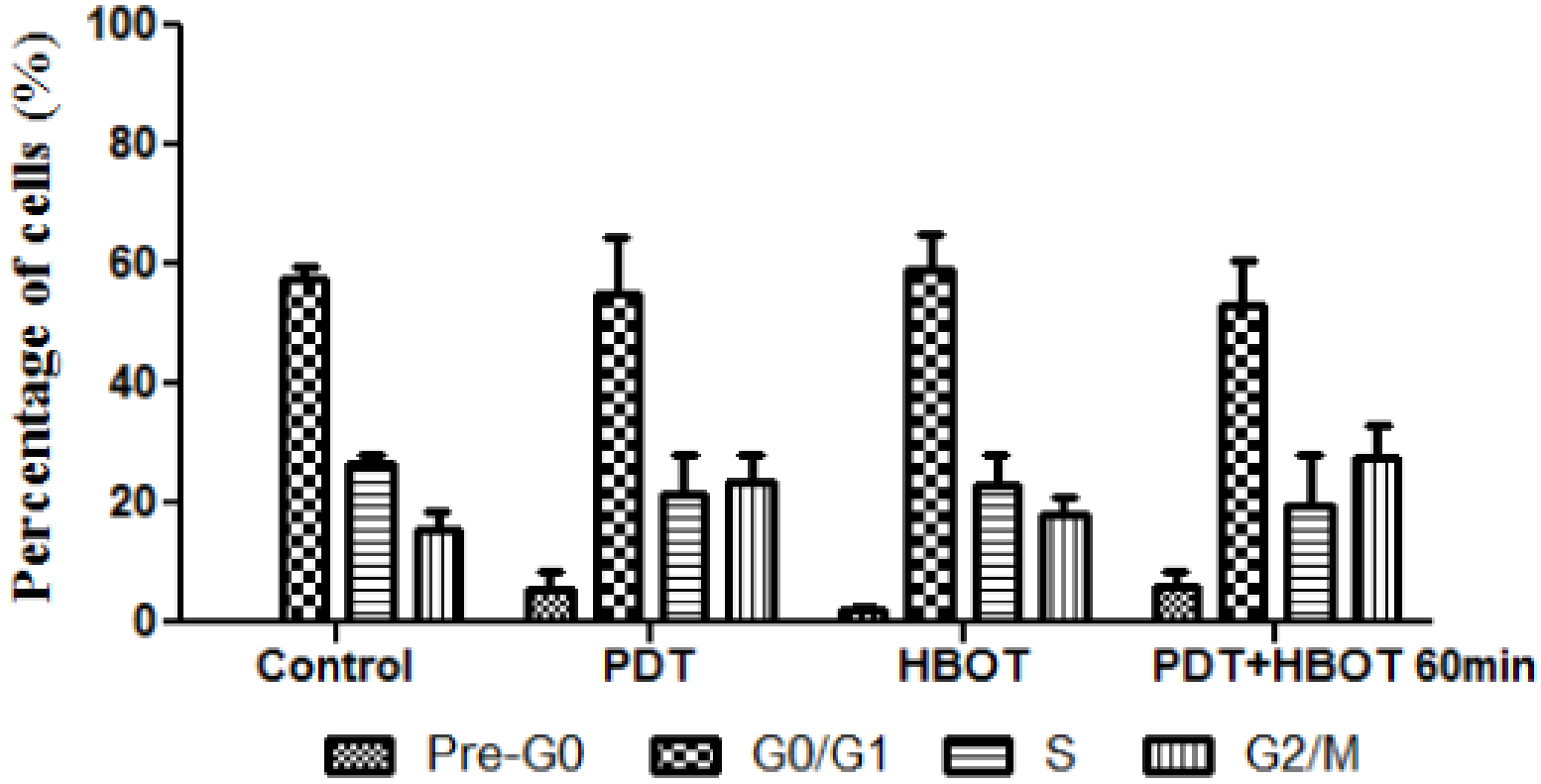


Figure 12. *Results of cell cycle analysis. Phases of the cell cycle 24h after the treatment*

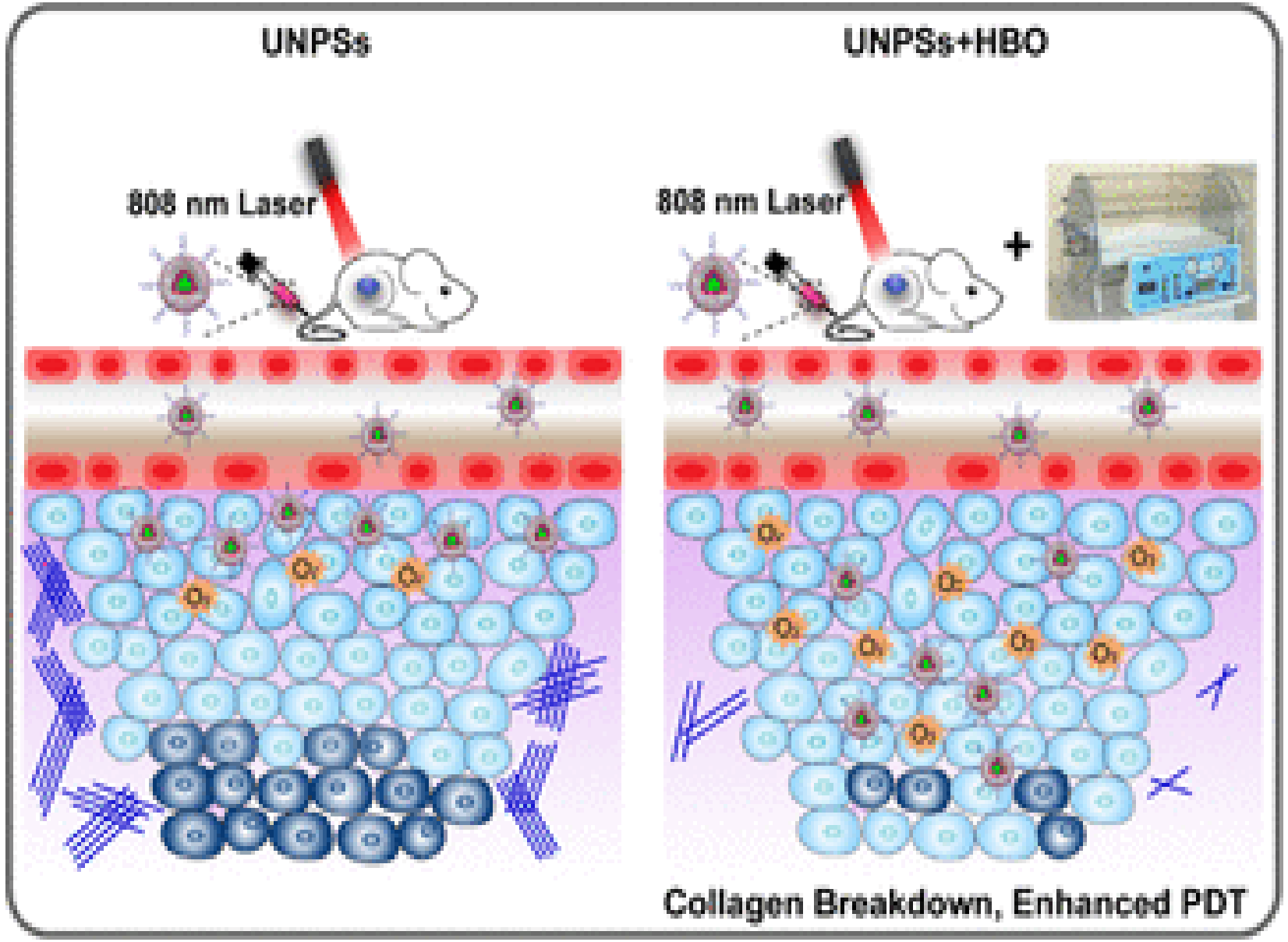
Other Data?

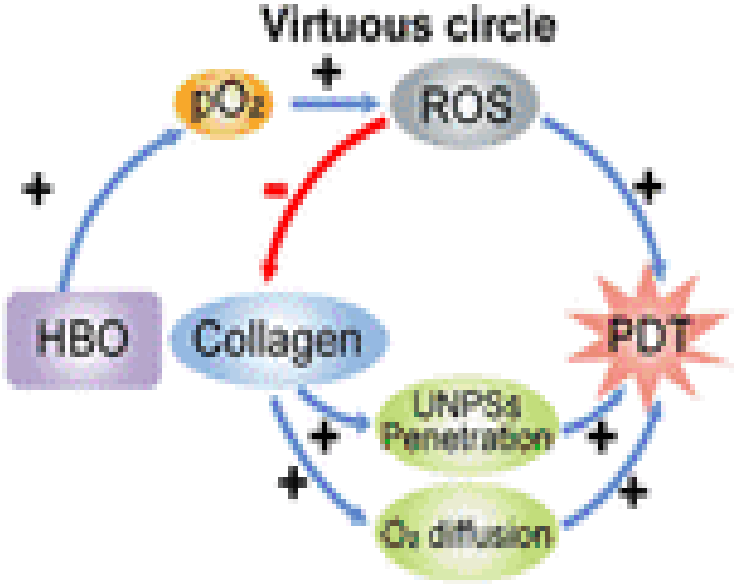
- (2016) + A. Neves, A. Abrantes, A. Pires, R. Teixo, M.F. Botelho. Hyperbaric oxygen therapy combined with photodynamic therapy as a new therapeutic approach against retinoblastoma. DOI: https://doi.org/10.1016/S0959-8049(16)61507-1

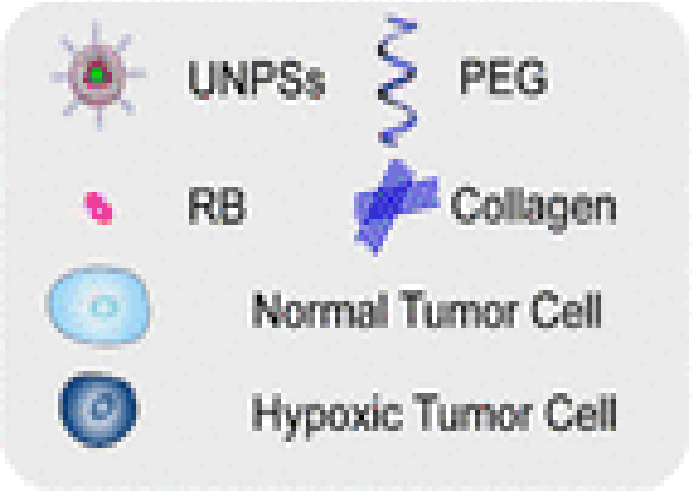
- (2016) Excellent review with extensive immunology data on PDT: Photodynamic Therapy of Non–Small Cell Lung Cancer. Narrative Review and Future Directions. https://doi.org/10.1513/AnnalsATS.201509-650FR.PMID26646726

Synergizing Upconversion Nanophotosensitizers with Hyperbaric Oxygen to Remodel the Extracellular Matrix for Enhanced Photodynamic Cancer Therapy. ACS Appl. Mater. Interfaces 10, 27, 22985-22996 (2018) +

"**With HBO, photodynamic process can generate abundant ROS in the intrinsically hypoxic tumor**. It is revealed for the first time that HBO-assisted PDT decomposes collagen in the extracellular matrix of tumor and thus facilitates the diffusion of oxygen and penetration of UNPSs into the deeper area of tumor. **Such a synergic effect eventually results in a significantly enhanced therapeutic efficacy** at a low laser power density as compared with that using UNPSs alone. **In view of its good biosafety, the HBO-assisted and UNPSs-mediated PDT** provides new possibilities for treatment of solid tumors."


UNPSs
UNPSs+HBO
808 nm Laser
808 nm Laser
Collagen Breakdown, Enhanced PDT


Virtuous circle
pO2
ROS
HBO
Collagen
PDT
UNPSs Penetration
O2 diffusion


UNPSs
PEG
RB
Collagen
Normal Tumor Cell
Hypoxic Tumor Cell

Photosensitizers:

Photosensitizer	Tissue-based or vascular-acting photosensitizer	Optimum dose (mg/kg)	Route of administration	Advantages	Disadvantages
Hematoporphyrin derivative	Tissue-based	1.50	Intravenous	NA	Difficult to manufacture reliably; prolonged skin sensitivity; drug–light interval of days
Porfimer sodium	Tissue-based	2.50	Intravenous	Commercial preparation of porfimer sodium is less heterogeneous than the original hematoporphyrin derivative	Prolonged skin sensitivity; drug–light interval of days
Temoporfin	Tissue-based	0.15	Intravenous	High quantum yield (i.e. a low drug dose is required to produce a photodynamic effect)	Prolonged skin sensitivity (up to 6 weeks); drug–light interval of 3–5 days; rectourethral fistula in a post-radiotherapy patient
Aminolevulinic acid-induced protoporphyrin IX	Tissue-based	20.00	Oral	Selectivity for prostate cancer over normal tissue; short drug–light interval (4 h)	NA
Motexafin lutetium	Vascular-acting	2.00	Intravenous	Short drug–light interval (3 h); no reported skin sensitivity	NA
Padoporfin	Vascular-acting	2.00	Intravenous	Short drug–light interval (min); no reported skin photosensitivity after 3 h; efficacy proven by reductions in PSA levels and imaging	Irregular and extraprostatic treatment effect reported on MRI

Abbreviation: NA, not applicable.

Medscape

Source: Nat Clin Pract Urol © 2009 Nature Publishing Group

Poly-MVA

Poly-MVA
aka. Lipoic Acid Mineral Complex (LAMC):

Known as the proprietary formula “Poly MVA” in North America, LAMC has shown to be helpful in cell repair, mitochondrial repair and radioprotection [18-21].

The author has found that low IV doses (5-15 mL) combined with low oral doses (5-10 mL BID) improve energy via mitochondrial support.

Poly-MVA Reference

LAMC (PolyMVA) – Anderson

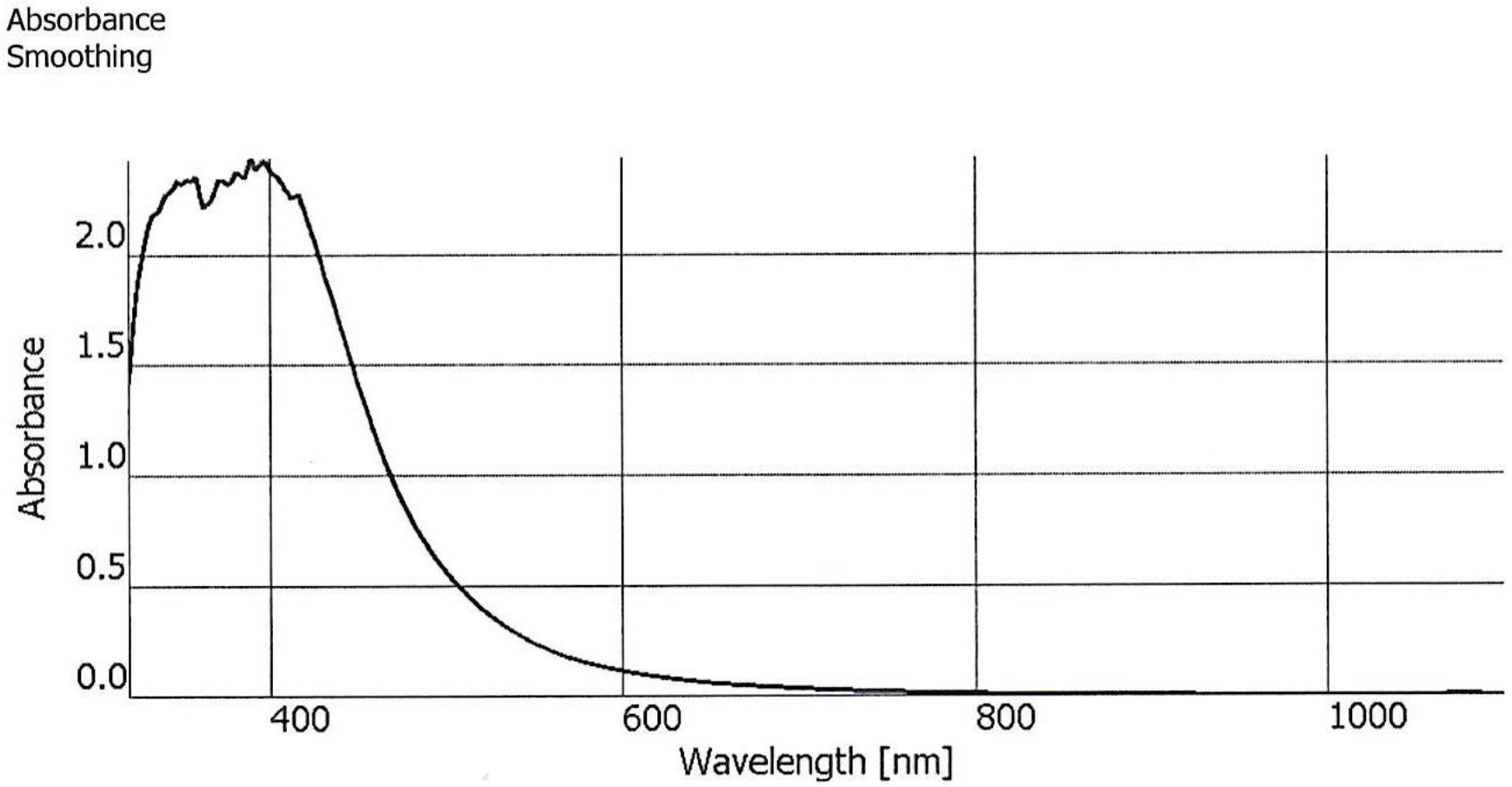
https://www.academia.edu/20316600/Lipoic_Acid_Mineral_Complex_PolyMVA_Monograph

Poly-MVA as a support

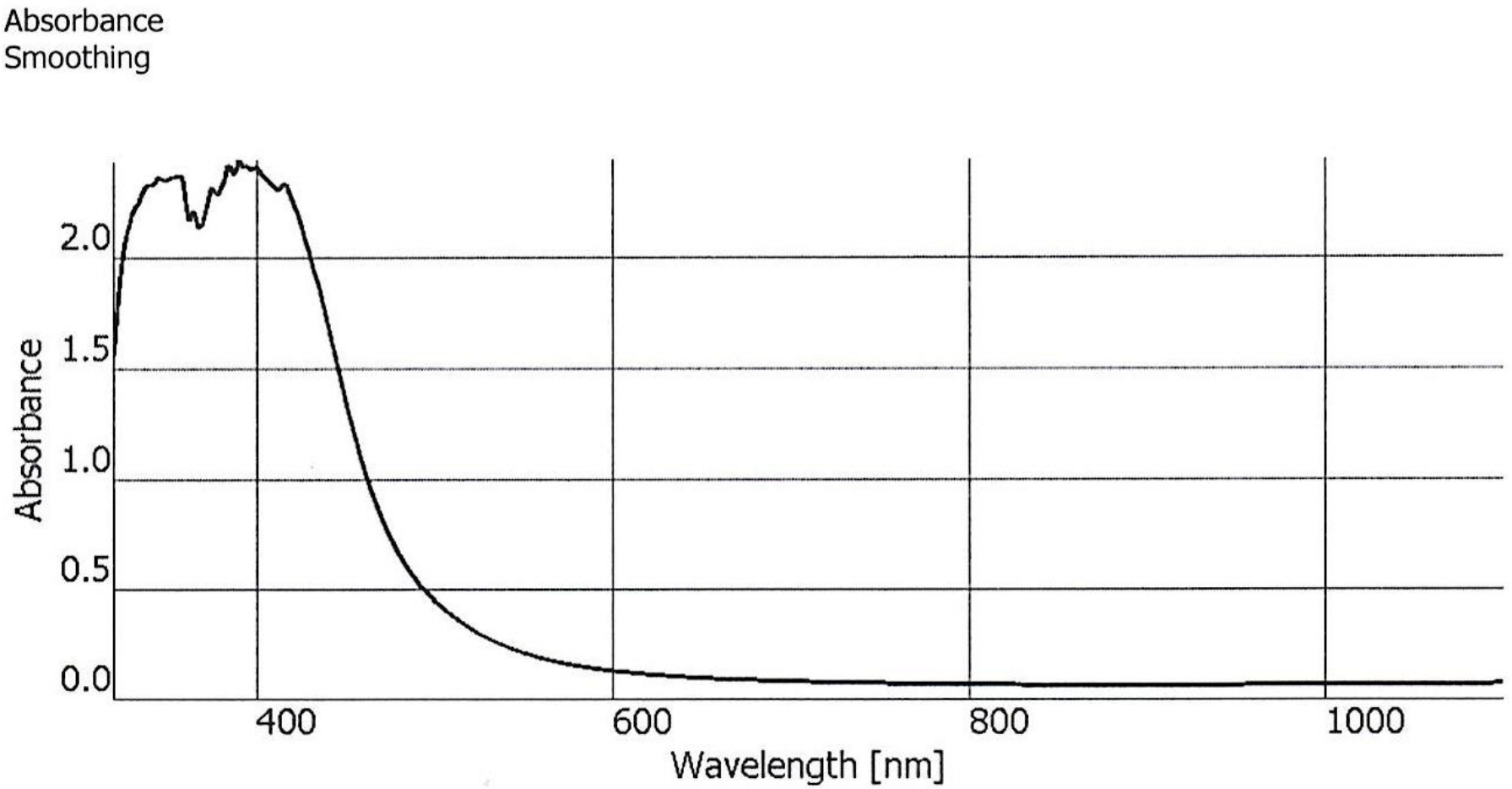
AND

Photosensitizer

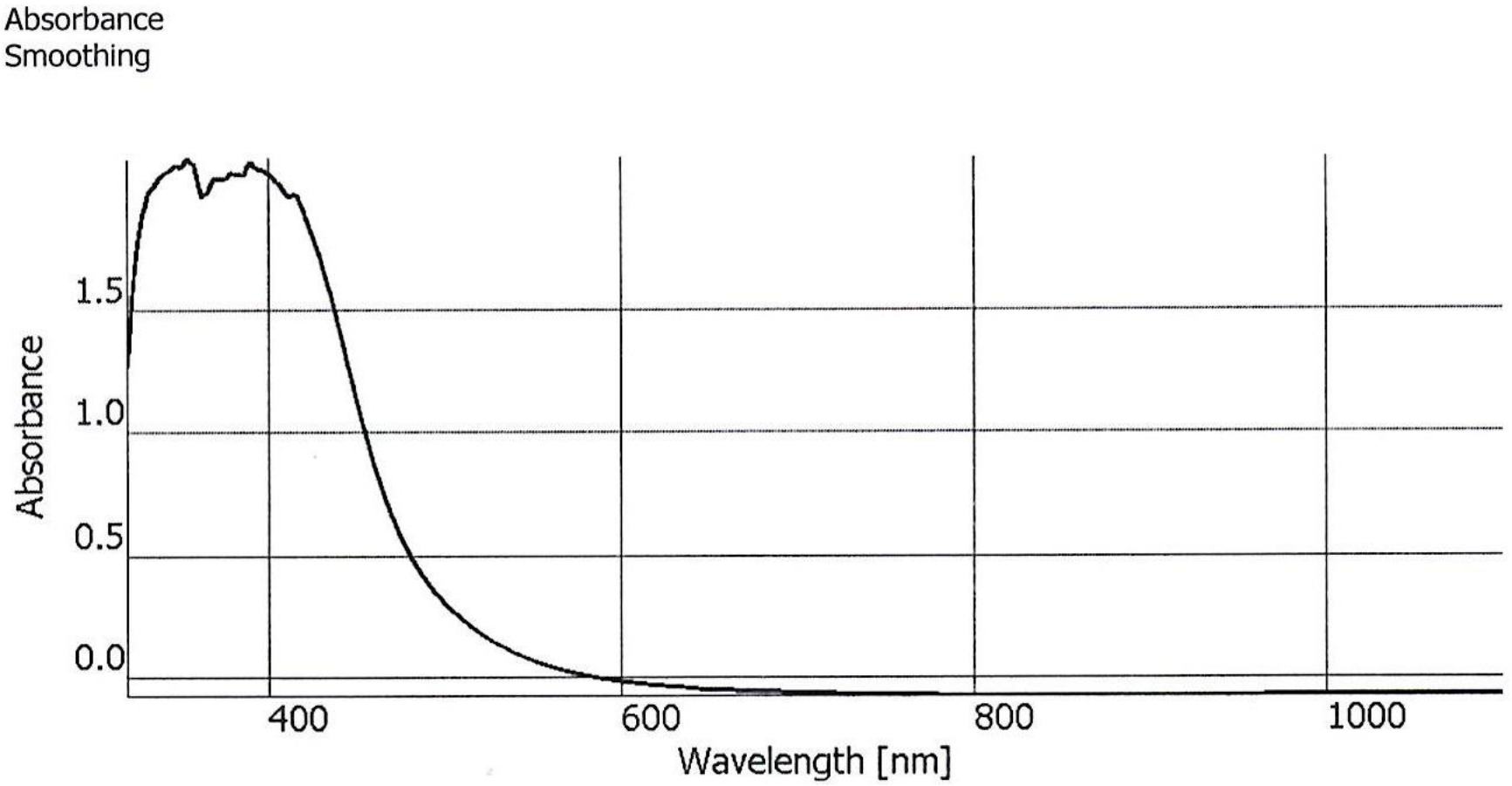
Poly-MVA Full Strength



Poly-MVA 50% Dilution



Poly-Plus (with retinoid)



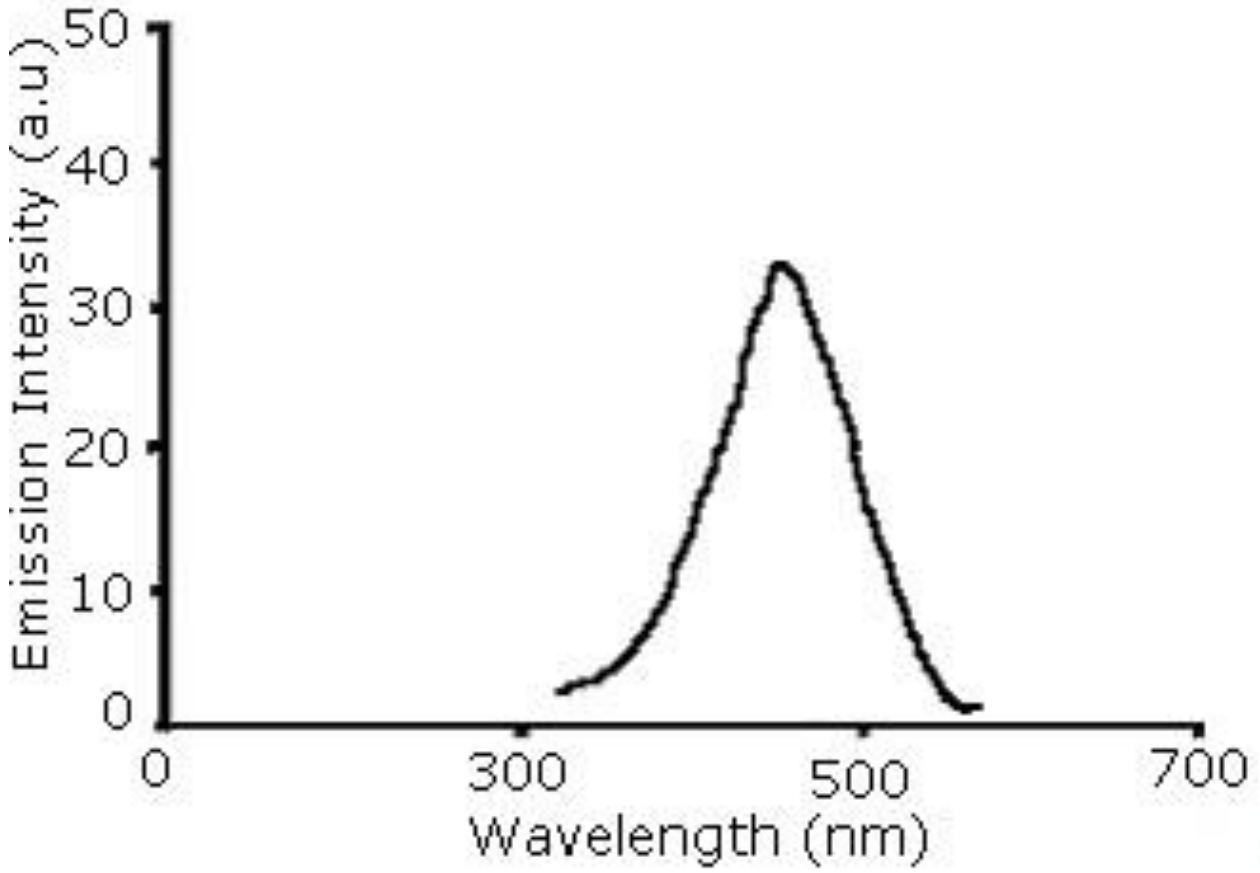
BLUE LASER (REGENERATION, EASE, COOLING)

WAVELENGTH : 451 nm - 495 nm
ABSORPTION : almost completely absorbed at skin.
Absorbed by **HAEMOGLOBIN** and by the NADH-dehydrogenase-complex, the starter complex of the RESPIRATORY CHAIN IN THE MITOCHONDRIA.

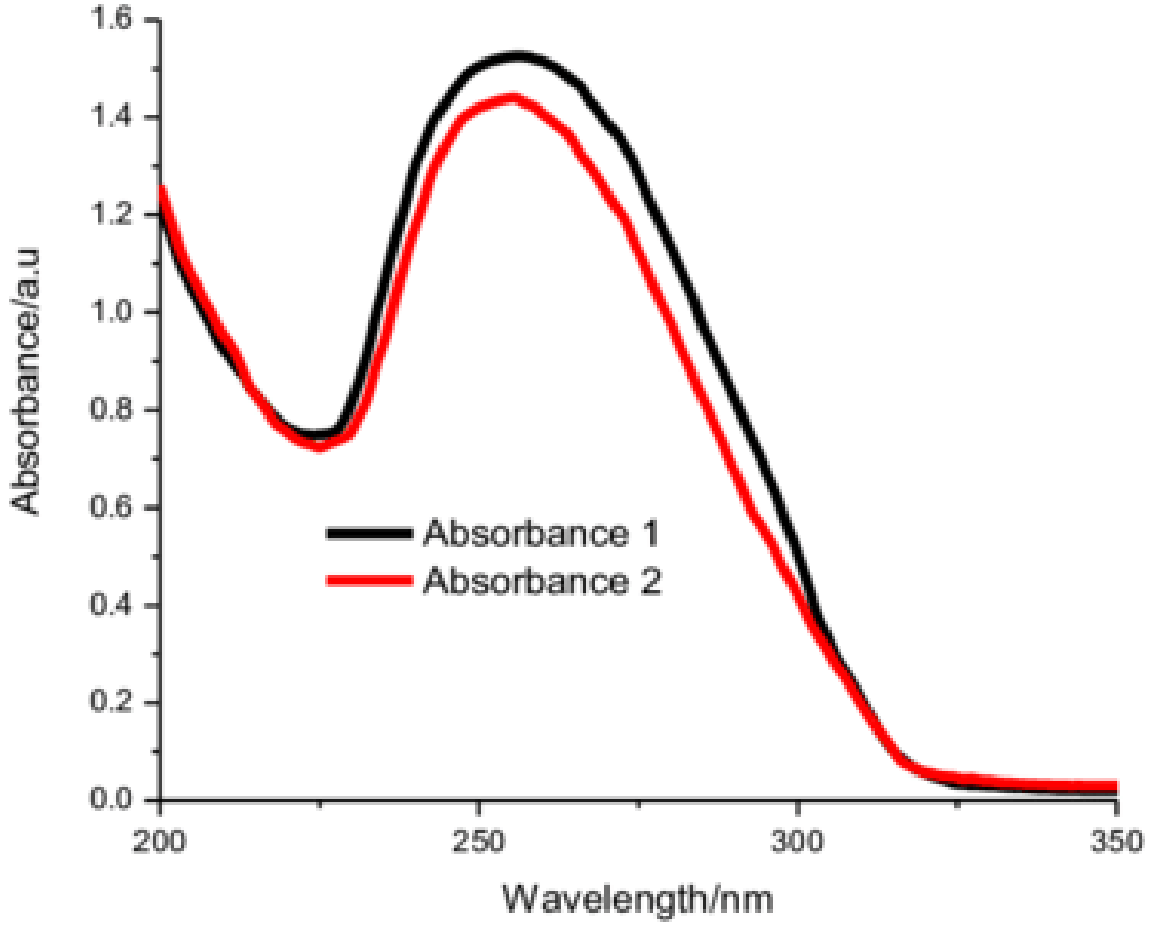
PENETRATION DEPTH : 1 - 2 mm

TREATMENT INTENSITY (inW/mw): 50 - 60 mW (p.611).
30 mW for interstitial and intra-articular laser therapies.

Silver Nanoparticles
(we use 23 ppm Argentyn)

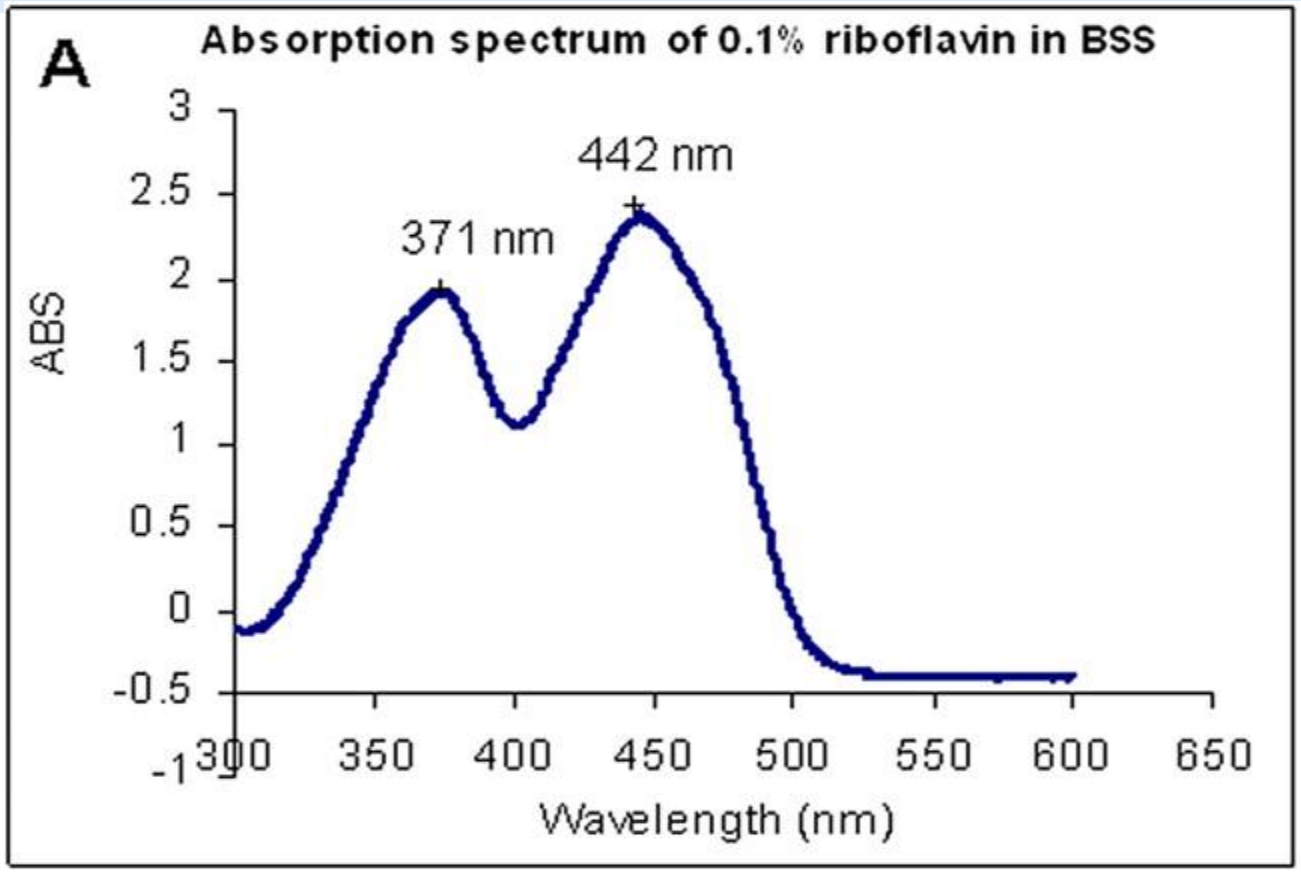


Thiamine (B-1)



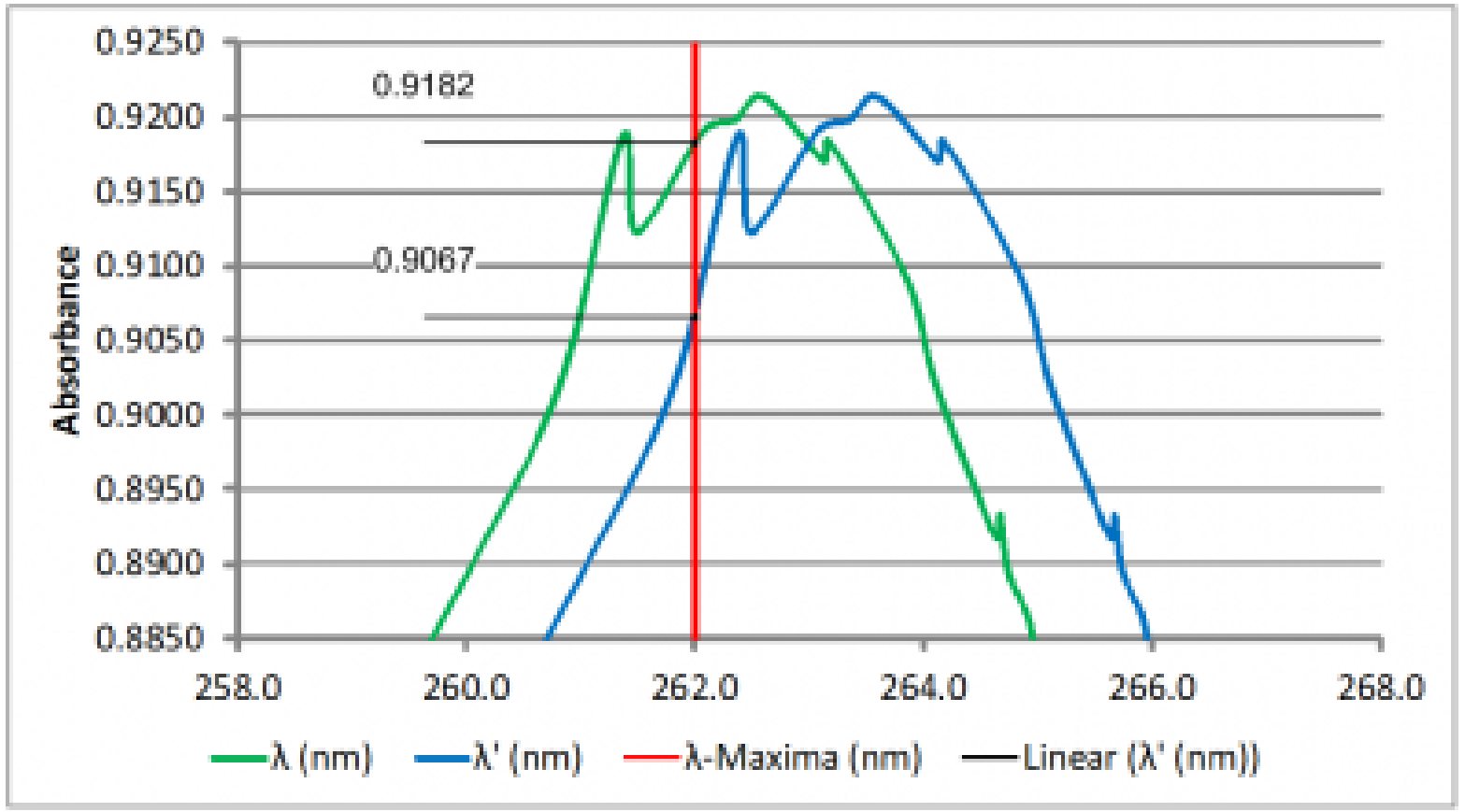
DOI: 10.5897/AJPP2016.4542

Riboflavin (B-2)



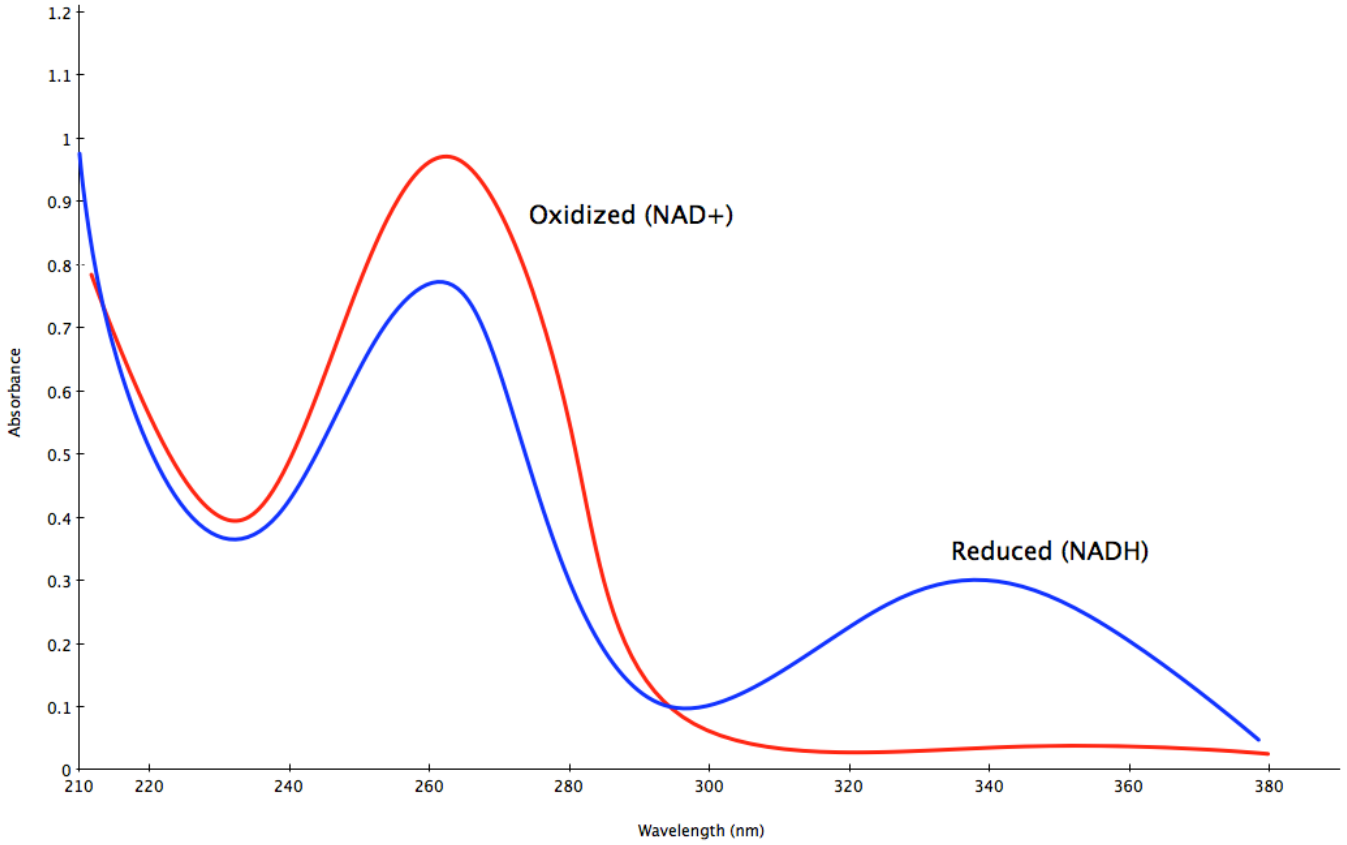
doi:10.1167/iovs.12-9537

Niacin (B-3)



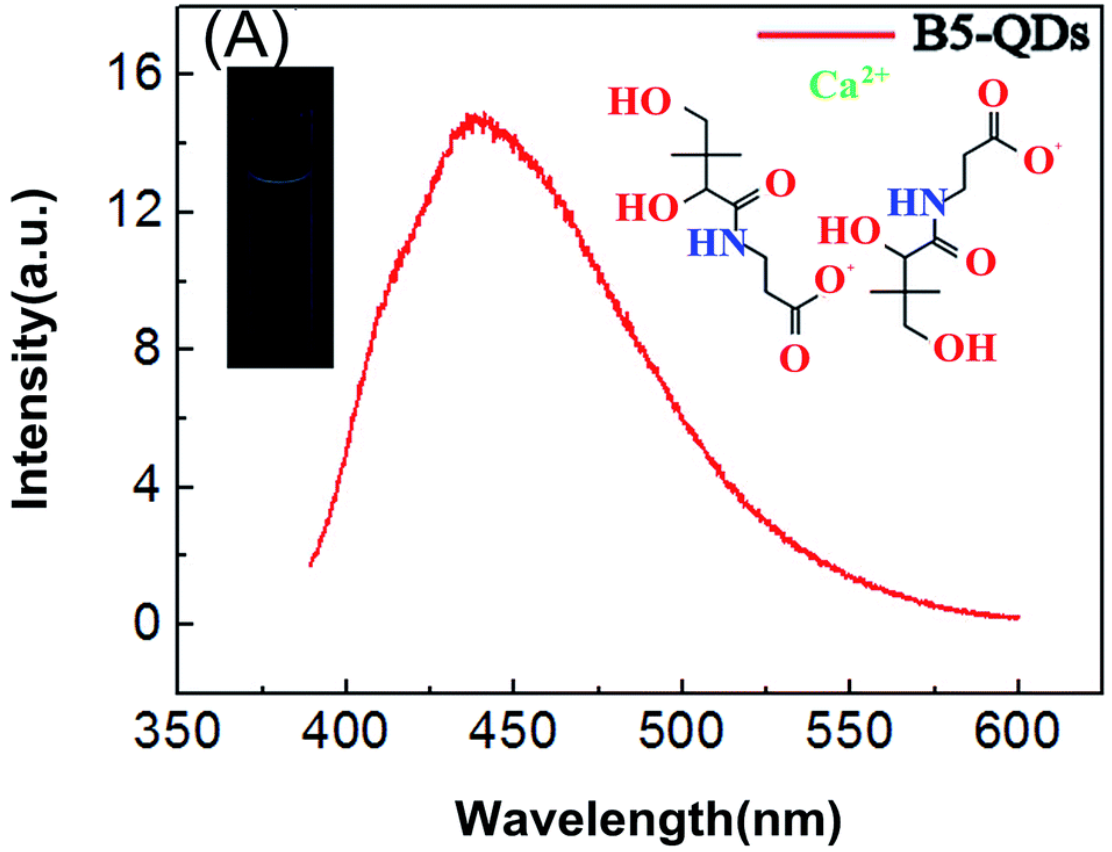
https://www.propharmagroup.com/blog/impact-wavelength-accuracy-and-precision-spectrophotometric-measurements/

NAD-NADH from Nicotinamide (B-3)



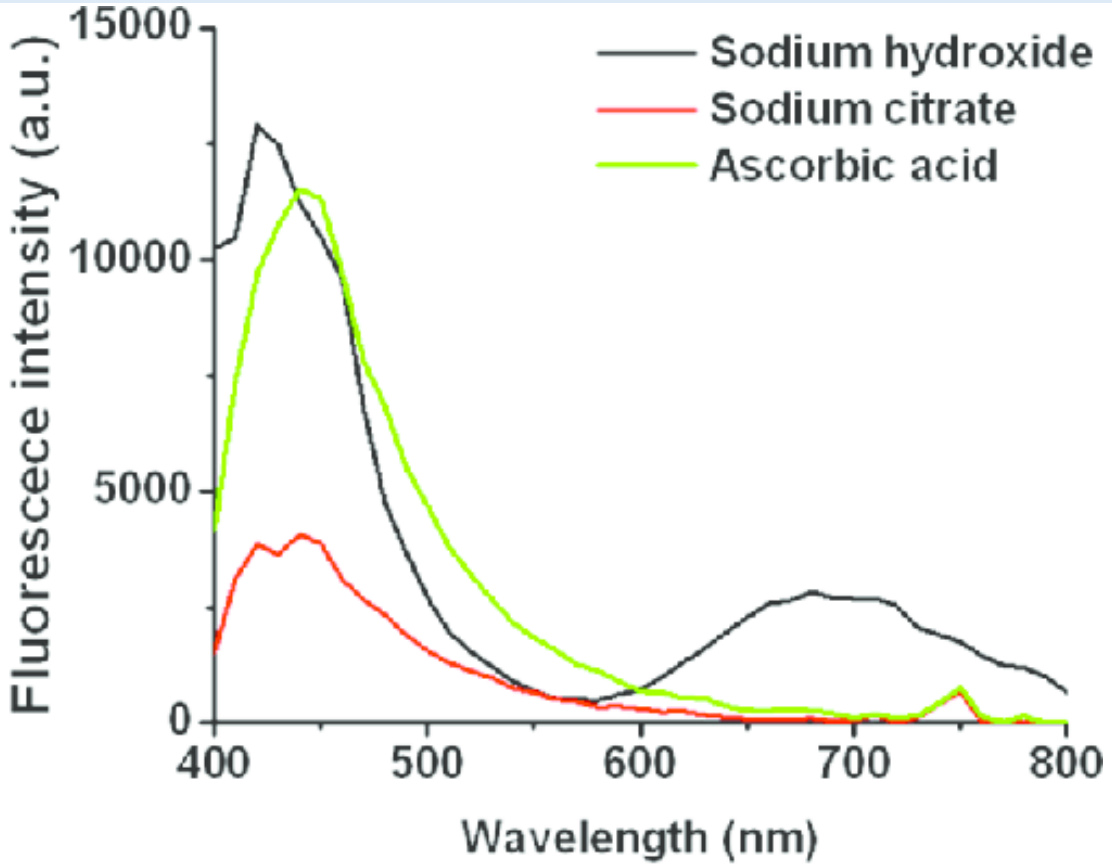
https://socratic.org/questions/how-does-a-spectrophotometer-work

Pantothenic Acid (B-5)



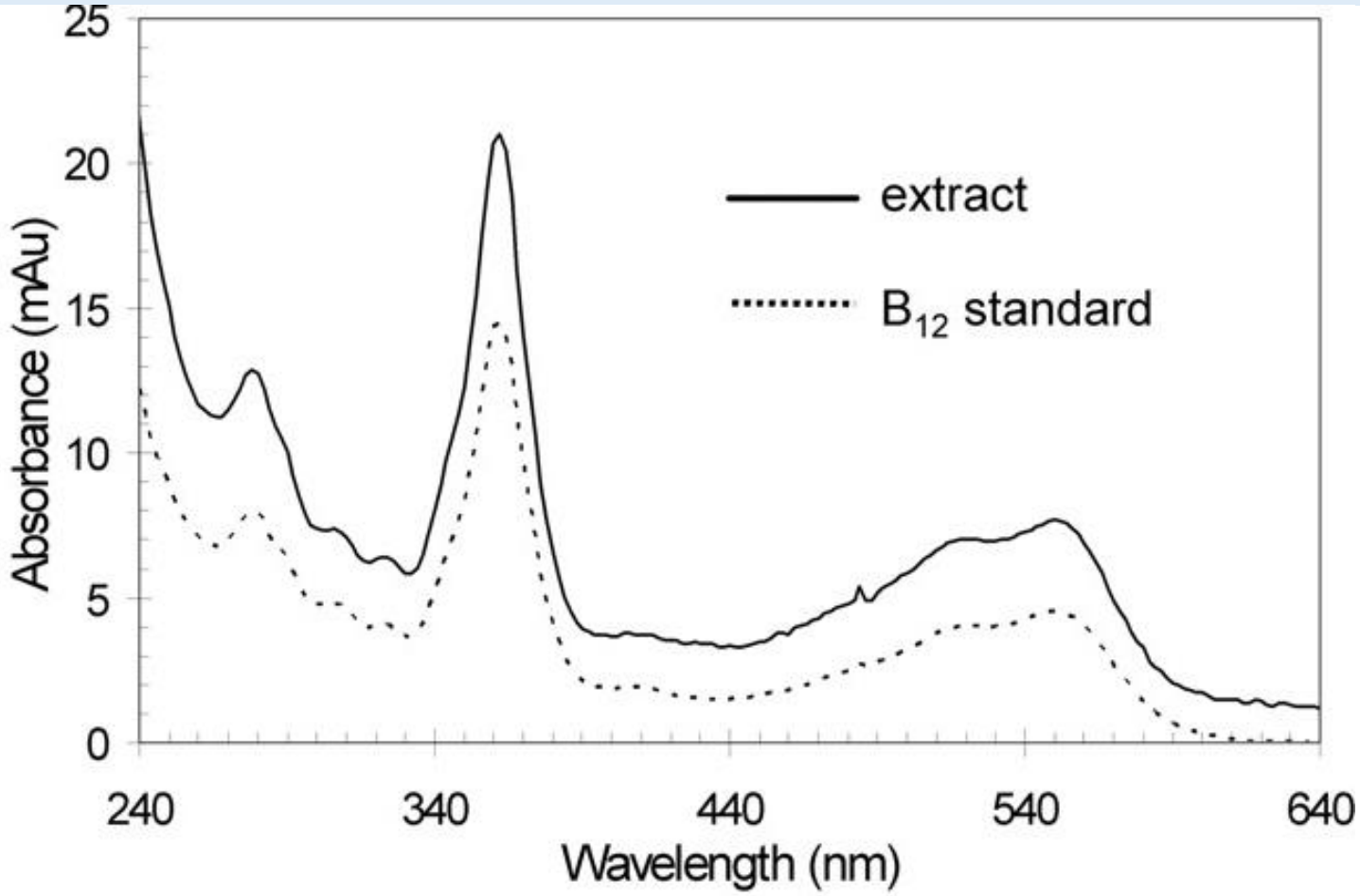
http://pubs.rsc.org/services/images/RSCpubs.ePlatform.Service.FreeContent.ImageService.svc/ImageService/Articleimage/2015/RA/c5ra14720d/c5ra14720d-f7_hi-res.gif

Vitamin C



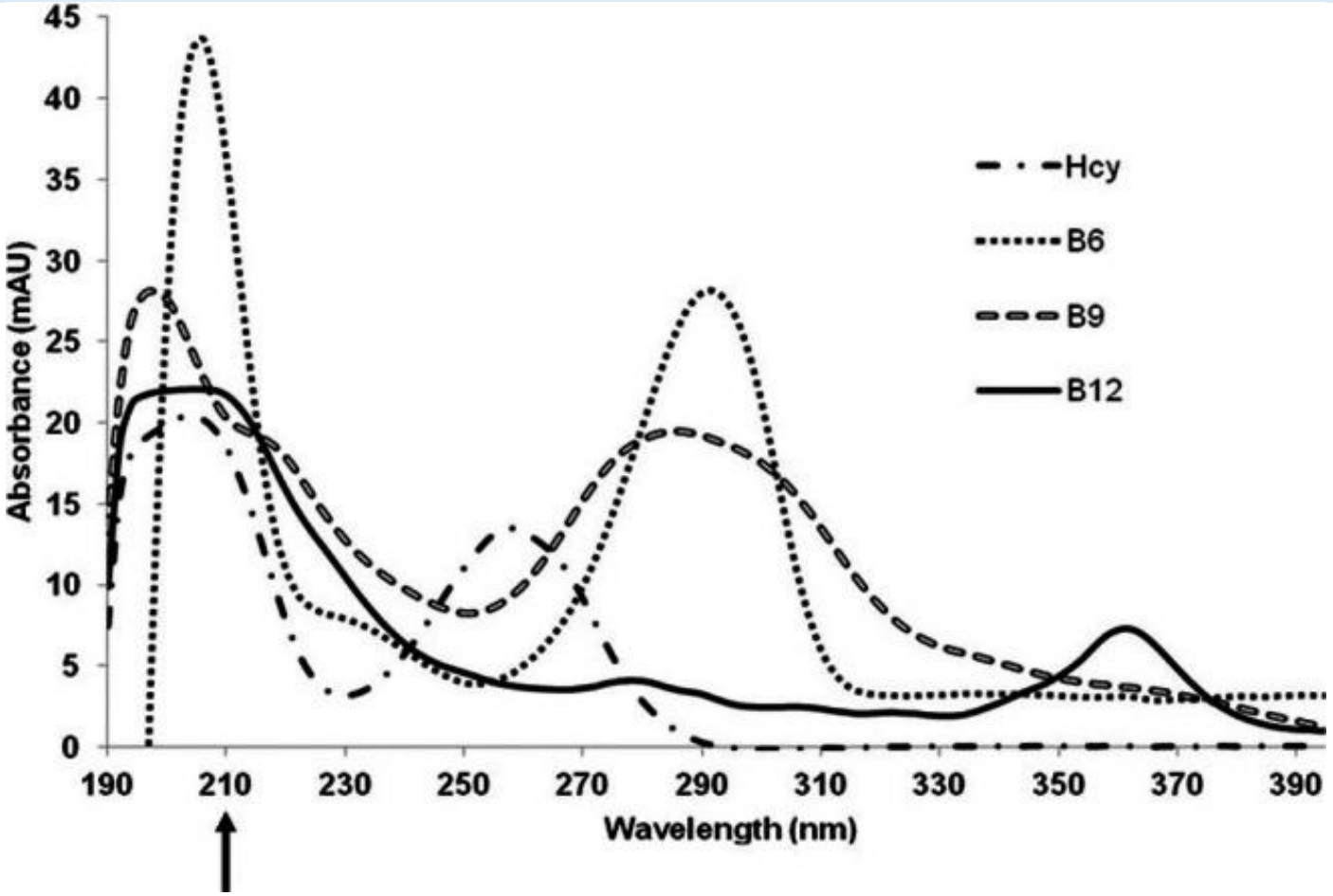
https://www.researchgate.net/profile/Aitziber_Cortajarena/publication/308698287/figure/fig2/AS:414508720902145@1475837988353/Fluorescence-emission-spectra-of-C3-Cys-stabilized-AuNCs-under-different-reaction.png

B-12



http://www.pnas.org/content/pnas/103/15/5694/F3.large.jpg

B-6; Folate; B-12

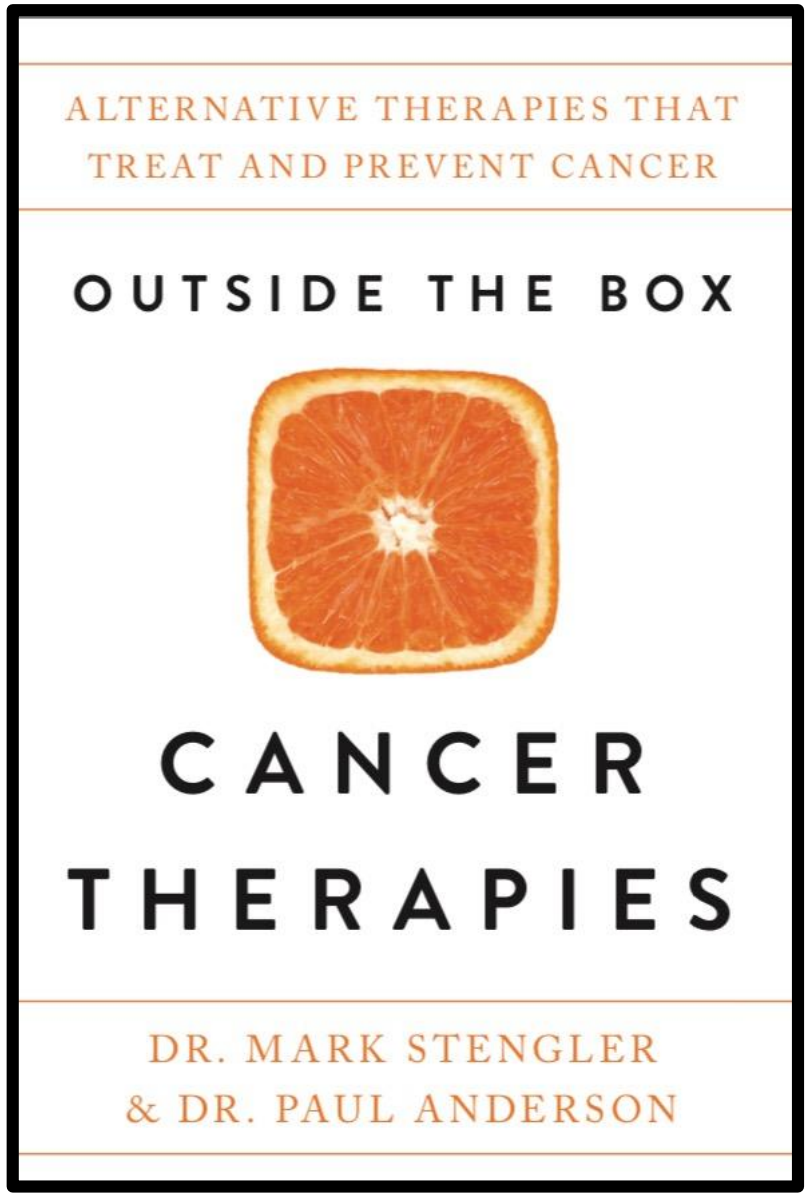


https://www.researchgate.net/publication/236958986/figure/fig2/AS:202804317691911@1425363725533/UV-spectra-of-homocysteine-1-mg-ml-vitamin-B6-1-mg-ml-folic-acid-1-mg-ml-and.png

Summary:

- PDT Laser is an incredibly potent therapy
- PDT – Laser has many potential applications in chronic, acute and cancerous states.
- PDT + HBOT has been shown to be synergistic
- Multiple photosensitizers beyond the “known agents” are available and potentially synergistic.

NEW! Integrative Oncology Book



Next:

- AAMP Portland: Chronic Infectious Illness and Advanced Integrative Medicine. September 28 - 30, 2018

www.aampportland.com

- Dr. A Web:

www.ConsultDrA.com

Thanks